THE TeleChoice REPORT ON

Volume Four
Number Nine
September 1999

xDSL

Analysis of Local Loop Technology and Services

This Month:

The TeleChoice Report On xDSL © 1999
Published monthly by **TeleChoice, Inc.**
8555 N. 117th East Avenue, Suite 101
Owasso, OK 74055
Voice: +1.918.274.0251 • Fax: +1.918.274.0254
Editor-in-Chief, **Laurie Falconer;** Assistant Editors, **Tim Stansbury, Patrick Hurley;** Managing Editor, **Melodee Kelly;** Columnists, **Peter Bourne, Patrick Hurley, Ken Kolderup, Tim Stansbury;** Production Manager, **Jamie Samilio;** Advertising Manager, **Harriet Linskey;** Editorial Steering Committee, **Jim Southworth, Jurgen Lison, Greg Gum, Sayuri Sharper, Chuck Haas, and Monty Sharma;** Publisher, **Daniel D. Briere.**
For information or to order, call **Judy Hughes,** +1.303.457.0352 or Email: xdsl@telechoice.com. Subscriptions US$895 yearly, outside N. America US$1,095. In Canada, add 7% GST (GST Reg. No. Pending). ISSN# 1087-9331.

DSL: Heralding the Future of Alternative Voice Service

DSL technology was originally designed to carry higher bit rate services such as video on demand. As time passed, the technology evolved to include next-generation voice and data services. Over the past several years, carriers have accepted DSL as the optimum platform for the future that will allow them to aggressively compete with the cable and wireless infrastructures. VoDSL (Voice over DSL) will essentially lead to a more competitive voice market, allowing businesses and consumers to seek alternative voice services from their CLECs (Competitive Local Exchange Carriers).

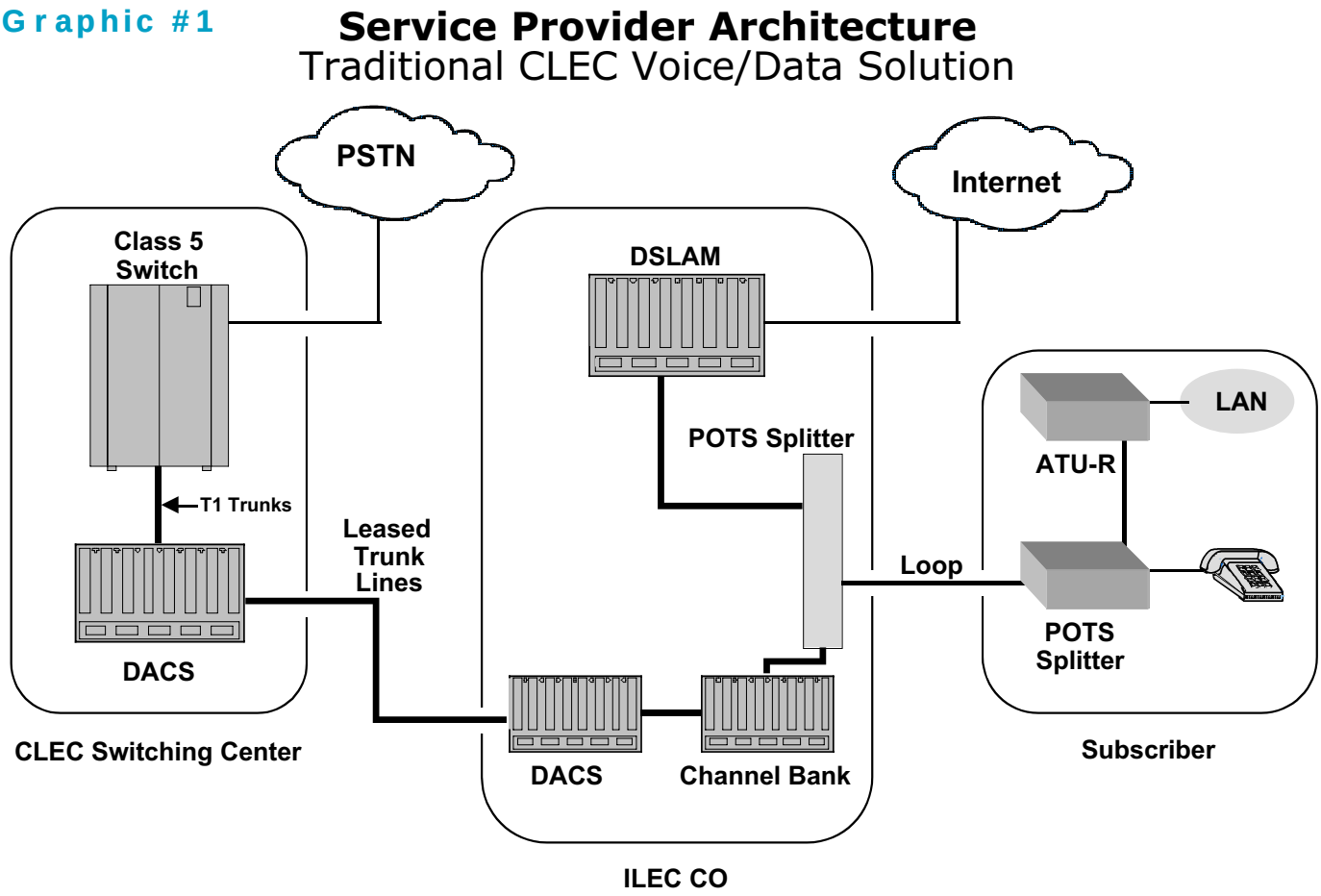
The Telecommunications Act of 1996 enabled CLECs to compete with the larger BOC (Bell Operating Company) carriers that provide voice and data, by allowing the CLECs access to the copper infrastructure previously unavailable to them. Traditionally, the Telecommunication Act stated that the CLECs needed a Class 5 switch in their infrastructure in order to carry voice in accordance with the Act. However, they were still very dependent on the ILEC (Incumbent Local Exchange Carrier) infrastructure since they would have to collocate their equipment in the CO and use the ILEC's data circuits to offload the voice services. This was very expensive and limited CLEC expansion. (**See graphic #1)**

In order to be more profitable, the CLECs needed architecture to bypass the ILEC infrastructure. With a combination of DSL and switching protocols,

DSL (continued on page 26)

DSL (continued from page 1)

Graphic #1



such as ATM (Asynchronous Transfer Mode), Frame Relay, and IP, the bypass mechanism was available. The CLEC finally found the "Holy Grail" needed to transfer voice from the subscriber to the CLEC without using expensive ILEC network elements to backhaul the voice traffic to their switches. The VoDSL application provided the solution for which the CLECs were searching **(See graphic #2)**

VoDSL

The four basic elements that make up the VoDSL architecture are the IAD (Integrated Access Device), the DSLAM (Digital Subscriber Line Access Multiplexer), the data switch and, the voice gateway.

The IAD will reside at the subscriber's location and most frequently consists of two to sixteen analog POTS (Plain Old Telephone Services) ports. The POTS lines can connect any analog telephones, fax machines, modems, KTS (Key Telephone Systems), or PBX systems. The IAD will also have a data connection of some type such as Ethernet, USB, ATM25, or V.35.

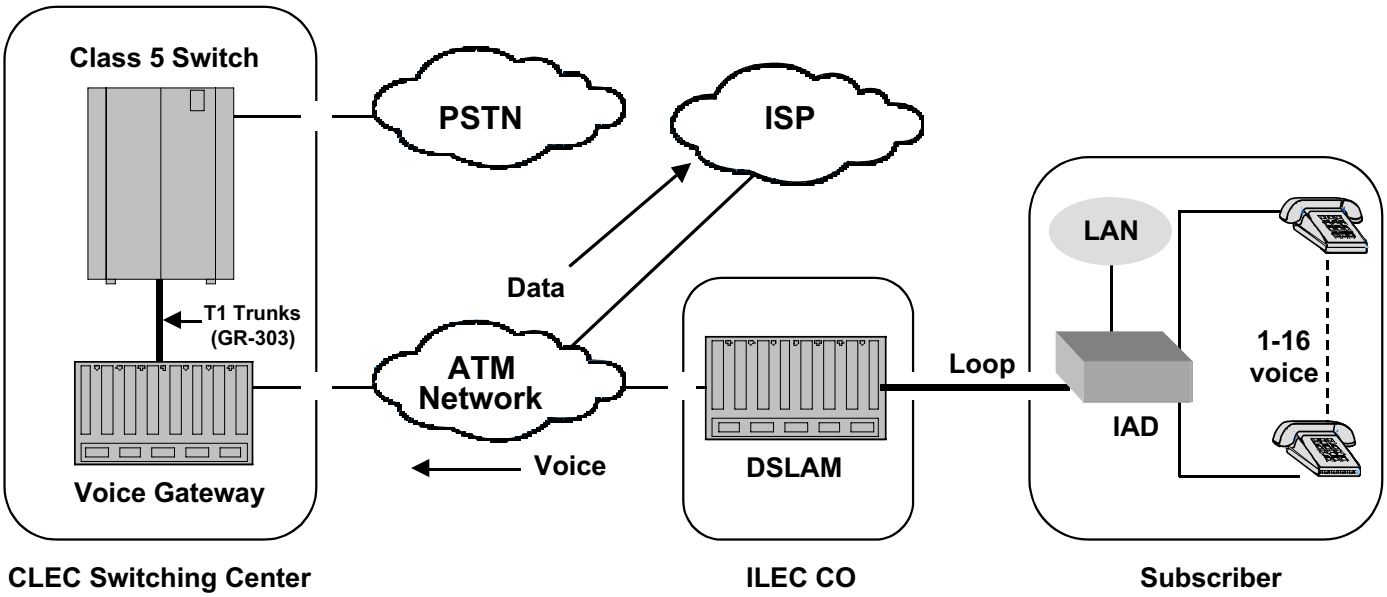
The DSLAM usually resides at the ILEC's central office. The DSLAM's main purpose is to terminate DSL lines from the customer premises and act as a backhaul facility for data and voice traffic from the subscriber. The role of the DSLAM in the VoDSL architecture is vital because it provides the perfect physical pathway for voice and data—enabling them to coexist on a single copper pair.

The data switch uses an ATM, Frame Relay, or IP protocol that receives traffic from each DSLAM and redirects it to an appropriate termination point. This switch is an efficient way to link data traffic to the ISP infrastructures and direct voice traffic to the final component of the VoDSL architecture—the voice gateway.

The voice gateway receives voice traffic from the subscriber in packet format and efficiently reconstructs it to be received by the service provider's Class 5 voice switch through standard TDM (Time Division Multiplexing) trunks using a GR-303 interface. The GR-303 is a Bellcore or now Telcordia-defined interface

Graphic #2

Service Provider Architecture
VoDSL Solution



between a Class 5 switch and remote digital terminal equipment that provides PSTN access to analog loops.

VoDSL Protocols and Network Products

ADSL (Asymmetric Digital Subscriber Line) allows the subscriber to use a standard telephone and connect their PC via an ATU-R (ADSL Transmission Unit-Remote). Within the recent G.lite standard, the subscriber splitter was eliminated except for special line filters required on some telephones. VoDSL eliminates the splitter component required for ADSL and any type of DSL can now be used such as SDSL, HDSL, and VDSL.

There are multiple choices of VoDSL products today and each uses a different protocol such as ATM, Frame Relay, or IP for connection to the network. Jetstream is a company that offers ATM and Frame Relay VoDSL products. Coppercom and Accelerated Networks offer only ATM products. Tollbridge and Lucent Technologies offer IP VoDSL products. Sprint ION will go with ATM as its packetized voice solution (Fred Dawson, "FocusOn: A Work in Progress," *Inter@ctive Week*, July 1999) and Covad has announced plans to provide VoDSL to consumers and businesses also utilizing ATM transport technology.

VoDSL with Frame Relay is required by some DSLAMs, such as Lucent's DSLTNT and Copper Mountain's Copper Edge which can only use Frame Relay on the network between the IAD and the DSLAM. While standard development is underway, most Frame Relay networks don't currently have built-in QoS (Quality of Service) that is needed to prioritize the voice and data traffic out to the network. As a result, a proprietary priority mechanism needs to be implemented in the DSLAM to support the traffic. This mechanism is needed because the one VC (Virtual Circuit) that carries voice and the other VC that carries data will compete to gain access to the network. Since voice is time-sensitive and any delays can jeopardize voice quality, it must be given the highest priority.

Both Lucent and Tollbridge's IP-based VoDSL products are flexible because they are independent of the DSLAM subscriber technologies. However, it is still necessary to maintain priority of the voice and data traffic.

The best way to insure the integrity of voice traffic is to utilize the QoS that ATM protocols provide. ATM has a built-in mechanism to handle time-sensitive data, such as voice, and ATM allows voice to transmit out of the DSLAM uninterrupted. In this protocol the voice

DSL (continued on next page)

VC is given priority over the data VC. The data VC is typically set up as UBR (Unspecified Bit Rate), while the voice VC is configured as VBR (Variable Bit Rate) in real time.

Most of the solutions mentioned require ATM connection from the DSLAM to the Voice Gateway, typically using a DS3 or OC3 uplink for connection to the ATM network.

Voice Quality

The Service Providers have their own guidelines for offering voice and data services and the key to the success of VoDSL is that it has to be a transparent element. Subscribers will not tolerate any voice service that is not as good as what they are receiving today. The industry has accepted two modulation techniques for toll-quality voice: 64Kbps PCM (Pulse Code Modulation) and 32Kbps ADPCM (Adaptive Differential Pulse Code Modulation). All the Companies and products previously mentioned support these modulation techniques.

VoDSL Solutions

Next-generation DSL access concentrators will offer high performance and high capacity traffic aggregation and scalability. Service providers need them to support both frame relay and ATM protocols for communication with customer premise equipment. Furthermore, they must offer diverse QoS levels for subscribers and easily accommodate the VoDSL infrastructure. Interoperability with the likes of Jetstream, Coppercom, Tollbridge, and Lucent's PathStar will also be essential feature next-generation DSL access concentrators. **(See graphic #3)**

The PathStar integrates the voice gateway and the Class 5 switch, significantly reducing the complexity of deploying voice services. This also lowers the cost per subscriber versus the combined voice gateway and Class 5 switch, enabling independent telcos and CLECs to more easily and cost-efficiently provide alternative voice service. As CLECs become better equipped to provide VoDSL solutions at lower operating costs, they will be able to compete with the larger carriers and offer end users high-quality voice and data with equal or higher levels of guaranteed service.

John Kasha is the Product Line Manager for the Multi-DSL product line at Lucent Technologies and is also responsible for their voice strategy. Prior to joining the Lucent team, Kasha worked for ACT Networks and Micom Communications.

Lucent Technologies, headquartered in Murray Hill, NJ, designs, builds, and delivers a wide range of public and private network, communication systems and software, data networking systems, business telephone systems, and micro-electronic components. Bell Laboratories is the research and development arm for the company. ▲

Graphic #3

Service Provider Architecture
Lucent's VoDSL Solution